

**OROVILLE FERC RELICENSING
(PROJECT No. 2100)**


**INTERIM REPORT
SP-F3.2 TASK 2
SP-F21 TASK 1**

**APPENDIX A
MATRIX OF LIFE HISTORY AND HABITAT REQUIREMENTS FOR
FEATHER RIVER FISH SPECIES**

**LITERATURE REVIEW OF LIFE HISTORY AND
HABITAT REQUIREMENTS FOR
FEATHER RIVER FISH SPECIES**

SPOTTED BASS

JANUARY 2003

Element	Element Descriptor	General	Feather River Specific
General			
common name (s)	English name (usually used by fishers and laypeople).	Spotted Bass	
scientific name (s)	Latin name (referenced in scientific publications).	<i>Micropterus punctulatus</i>	
taxonomy (family)	Common name of the family to which they belong. Also indicate scientific family name.	Sunfish and bass - <i>Centrarchidae</i>	
depiction	Illustration, drawing or photograph.		
range	Broad geographic distribution, specifying California distribution, as available.	Spotted bass are native to the central and lower Mississippi Basin and in Gulf Coast drainages from northwestern Florida to western Texas. Their range in the West has been considerably expanded by introductions. In the West they have become established in California, New Mexico, Nevada, and Arizona. Presently, spotted bass are established in most of the larger foothill and coast range reservoirs in the Central Valley (including Shasta and Oroville) and streams associated with them (Moyle 2002).	
native or introduced	If introduced, indicate timing, location, and methods.	Northern spotted bass were brought into California from Ohio in 1933, propagated at the Friant Hatchery, and starting in 1937, widely planted in foothill rivers of the Sacramento and San Joaquin Valleys (Moyle 2002). Alabama spotted bass, from Alabama, were first successfully planted in Perris Reservoir (Riverside County) in 1974 and were then widely introduced into southern California and the	

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		Central Valley. Alabama spotted bass were introduced because of their ability to spawn successfully in fluctuating reservoirs (Moyle 2002).	
ESA listing status	Following the categories according to California Code of Regulations and the Federal Register, indicate whether: SE = State-listed Endangered; ST = State-listed Threatened; FE = Federally listed Endangered; FT = Federally-listed Threatened; SCE = State Candidate (Endangered); SCT = State candidate (Threatened); FPE = Federally proposed (Endangered); FPT = Federally proposed (Threatened); FPD = Federally proposed (Delisting); the date of listing; or N = not listed.	Spotted bass are not a listed species.	
species status	If native, whether: Extinct/extirpated; Threatened or Endangered; Special concern; Watch list; Stable or increasing. If introduced, whether: Extirpated (failed introduction); highly localized; Localized; Widespread and stable; Widespread and expanding.	Spotted bass are widespread and expanding. These fish are aggressive invaders that are still expanding their range to all suitable habitats (Moyle 2002).	
economic or recreational value	Indicate whether target species sought for food or trophy. Whether desirable by recreational fishers, commercial fishers, or both.	Spotted bass is sought as a recreational fish species.	They have been a major success in Oroville Reservoir, providing much of the bass fishery (Moyle 2002).
warmwater or coldwater	Warmwater if suitable temperature range is similar to basses; coldwater if suitable temperature range is similar to salmonids.	Spotted bass are considered warm water species.	

Element	Element Descriptor	General	Feather River Specific
pelagic or littoral	Environment: Pelagic - living far from shore; Littoral - living near the shore.	Spotted bass are generally considered a littoral species. In stream, they are secretive pool dwellers, avoiding riffles and backwater with growths of aquatic plants. In reservoir they are often most common along steep, rocky banks, usually towards the upstream end of the reservoir. In reservoirs, juveniles generally remain near shore in shallow water (Moyle 2002).	
bottom or water column distribution	Environment: bottom (benthic) or along water column.	Spotted bass are generally considered a species which is distributed in the water column. In reservoirs, adults tend to live at moderate depths from 3.3-13.1 ft (1-4 m), often just above the thermocline (Moyle 2002).	
lentic or lotic	Environment: Lentic - pertaining to stagnant water, or lake-like; Lotic - moving water, or river-like.	Spotted bass are generally considered a lentic species. In streams they are secretive pool dwellers, avoiding riffles and backwaters with heavy growth of aquatic plans. They prefer slower, more turbid waters than small mouth bass (Moyle 2002).	
Adults			
life span	Approximate maximum age obtained.	The life expectancy of spotted bass is approximately 6 years (Wang 1986). Few fish live longer than 4-5 years, so bass over 15.7 inches (40 cm) TL are unusual (Moyle 2002).	
adult length	Indicate: Length at which they first reproduce; average length and maximum length the fish can attain.	Spotted bass reach maturity during their second or third year (Moyle 2002). Growth rates vary with habitat, with the fastest rates typically achieved in fairly new warmwater reservoirs and with the slowest growth rates occurring in cool streams. Spotted bass reach 2.6-6.7 inches (65-170 mm TL) in their first year, 5.9-12.8 inches (150-325 mm) in their second year, 8.1-15.9 inches (205-405 mm) their third year, 9.6-17.1 inches (245-435 mm) their fourth year, 12.4-19.9 inches (315-505 mm) their fifth year, 11-22.2 inches (280-565 mm) their sixth year, and 12.4-24 inches (315-610 mm) their seventh year (Moyle 2002).	
adult weight	Indicate: Weight at which they first reproduce; average weight and maximum weight the fish can attain.	The angling record in California is a 9.5 pounds (4.3 kg) spotted bass caught in Pine Flat Reservoir in 1996 (Moyle 2002).	
physical morphology	General shape of the fish: elongated, fusiform, laterally compressed, etc.	Spotted bass are elongated, much like largemouth bass (Moyle 2002).	

Element	Element Descriptor	General	Feather River Specific
coloration	Indicate color, and color changes, if any, during reproduction phase.	Coloration is olivaceous on the back and white on the belly, with a blotched stripe in between (Moyle 2002).	
other physical adult descriptors	Unique physical features for easy identification.	The first dorsal fin is not strongly convex, the upper jaw rarely extends beyond the rear margin of the eye, the lower sides have rows of distinct black spots, there are teeth in a rectangular patch on the middle of the tongue, usually a distinct spot at the end of the lateral band at the base of the tail (Moyle 2002).	
adult food base	Indicate primary diet components.	Their diet changes with size, reflecting differences in both mouth size and habitat across life history stages. Fish measuring 75-150 mm feed on, in order of importance, aquatic insects, fish, crayfish, and terrestrial insects. Cray fish become increasingly important for larger spotted bass. The most common fish prey in reservoirs are sunfish, crappie, and threadfin shad. They also prey on their own young and those of other bass species (Moyle 2002).	
adult feeding habits	Indicate whether plankton eater, algae eater, bottom feeder, piscivorous, active hunter, ambush predator, filter feeder. Night, day, dusk or dawn feeder.	Spotted bass are active hunters (Moyle 2002).	
adult in-ocean residence time	For anadromous species, age when they migrate to the ocean and duration spent in the ocean before returning to freshwater to spawn.	N/A	
adult habitat characteristics in-ocean	For anadromous species, description of the ocean habitat utilized: whether along major current systems, gyres, pelagic (beyond continental shelves) and neritic (above continental shelves) zones, etc.	N/A	
Adult upstream migration (immigration)			
range of adult upstream migration timing	Time of year adults migrate upstream. If applicable, indicate for various runs.	N/A	

Element	Element Descriptor	General	Feather River Specific
peak adult upstream migration timing	Time of year most adults migrate upstream. If applicable, indicate for various runs.	N/A	
adult upstream migration water temperature tolerance	Range of water temperatures allowing survival. Indicate stressful or lethal levels.	N/A	
adult upstream migration water temperature preference	Range of suitable, preferred or reported optimal water temperatures. Indicate whether literature, observational, or experimental.	N/A	
Adult holding (freshwater residence)			
water temperature tolerance for holding adults	Range of water temperatures allowing survival. Indicate stressful or lethal levels.	<p>Spotted bass prefer summer temperatures 75.2°F-87.8°F (24°C-31°C) (Moyle 2002).</p> <p>In the Wabash River, Indiana, the lower and upper avoidance temperatures are 71.6°F (22°C) and 80.6°F (27°C), respectively (Coutant 1977).</p> <p>In lab studies, the lower and upper avoidance temperatures are 80.6°F (27°C) – 93.2°F (34°C), respectively (Coutant 1977).</p>	
water temperature preference for holding adults	Range of suitable, preferred or reported optimal water temperatures. Indicate whether literature, observational, or experimental.	<p>In Norris Reservoir, Tennessee, 75.9°F (24.4°C) was determined to be the preferred temperature (Coutant 1977).</p> <p>In lab studies, 90.5°F (32.5°C) was determined to be the preferred temperature (Coutant 1977).</p>	
water depth range for holding adults	Reported range of observed (minimum and maximum) water depth utilization.	Spotted bass tend to live at moderate depths ranging from 3.3-13.1 ft (1-4 m), often just above the thermocline. In reservoirs, they may seek out deep water at 98 –130 feet (30 – 40 m) once water temperature becomes uniform in autumn (Moyle 2002).	
water depth preference for holding adults	Reported range of most frequently observed water depth utilization.		

Element	Element Descriptor	General	Feather River Specific
substrate preference for holding adults	If bottom dwellers, indicate substrate: mud, sand, gravel, boulders, aquatic plant beds, etc. If gravel, indicate range or average size of gravel.	In reservoirs they are most common along steep, rocky banks, usually toward the upstream end of the reservoir (Moyle 2002).	
water velocity range for holding adults	Reported range of observed (minimum and maximum) water velocity utilization.		
water velocity preference for holding adults	Reported range of most frequently observed water velocity utilization.		
other habitat characteristics for holding adults	General description of habitat (e.g. turbid or clear waters, lentic or lotic, presence of aquatic plant beds, debris, cover, etc.).	<p>In streams, spotted bass are secretive pool dwellers, avoiding riffles and backwaters with heavy growths of aquatic plants, like slower more turbid water than smallmouth bass and faster water than largemouth bass (Moyle 2002).</p> <p>Spotted bass have relatively low tolerance for brackish water, but they have been found in water with salinities up to 10 ppt (Moyle 2002).</p>	
timing range for adult holding	Time of year (earliest-latest) and duration of stay from upstream migration to spawning.	N/A	
timing peak for adult holding	Time of year when maximum number of adults are present before spawning.	N/A	
Spawning			
fecundity	Average or range in the number of eggs females lay in a spawning season.	<p>The number of eggs in each nest ranges from 2,000-2,500 eggs per nest (Wang 1986).</p> <p>In Lake Perris, five nests were observed with number of eggs ranging 3,000-14,000 per nest. The average number of eggs per nest was 7,940 (Aasen et al. 1981).</p> <p>Each nest contains 2,000-14,000 young (Moyle 2002).</p>	
nest construction	Location and general description of nest -- substrates, aquatic plants, excavations, crevices, habitat types, etc.	Males construct nests in areas of large rocks, rubble or gravel. In streams, nests are constructed in low-current areas on bottoms ranging from debris to gravel (Moyle 2002).	

Element	Element Descriptor	General	Feather River Specific
nest size	Size and average dimensions of the nest.	<p>In Lake Perris, five nests were observed measuring from 11.8 by 11.8 inches (30 by 30 cm) to 29.5 by 27.6 inches (75 by 70 cm), averaging 427 square inches (2,754 cm²) (Aasen et al. 1981).</p> <p>Nests are 15.7-31.5 inches (40-80 cm) in diameter (Moyle 2002).</p>	
spawning process	Indicate whether nest builder, broadcast spawner, or other.	<p>Spotted bass are nest builders. Breeding and parental behavior is similar to that of smallmouth bass. Some males will have more than one nest during the season (Moyle 2002).</p> <p>In Lake Perris, eggs are deposited 1 to 3 days after nest site is selected (Aasen et al. 1981).</p>	
spawning substrate size/characteristics	Range of substrates used during spawning (e.g. mud, sand, gravel, boulders, beds of aquatic plants). Indicate presence of plant/wood debris, crevices at spawning sites. If gravel, indicate range of average size.	<p>Based on literature review, spawning substrate ranges from mud to sand to gravel (Wang 1986).</p> <p>In Lake Perris, spawning activities occur almost entirely on rubble or large, flat rock substrate (Aasen et al. 1981).</p> <p>Males construct nests in areas of large rocks, rubble or gravel. In streams, nests constructed in low-current areas on bottoms ranging from debris to gravel (Moyle 2002).</p>	
preferred spawning substrate	Indicate preferred spawning substrate (e.g. mud, sand, gravel, boulders, plant bed, etc).	Spotted bass seem to prefer rock substrate for spawning. Of a total of 64 nests evaluated, 35 were found on rocks, 27 on rubble, and 2 on sand-gravel (Aasen et al. 1981).	
water temperature tolerance for spawning	Range of water temperatures allowing survival. Indicate stressful or lethal levels.	<p>Spawning reported begins when water temperature reaches 53.6°F – 54.5°F (12°C -12.5°C) (Wang 1986).</p> <p>In Perris Reservoir (Riverside County), the first sign of spawning is the movement of males into shallow water in late March and early April when temperatures are 57.2°F-59°F (14°C -15°C). It may continue through late May and early June, until temperatures reach 71.6°F-73.4°F (22°C -23°C) (Aasen et al. 1981).</p> <p>Spotted bass spawn when water temperatures rise to 59-64.4°F (15-18°C) (Moyle 2002).</p>	
water temperature preference for spawning	Range of suitable, preferred or reported optimal water temperatures. Indicate whether literature, observational, or experimental derivation.		

Element	Element Descriptor	General	Feather River Specific
water velocity range for spawning	Minimum and maximum speed of water current the spawning fish can tolerate.		
water velocity preference for spawning	Preferred water current (flow velocity) during spawning.		
water depth range for spawning	Reported range of observed (minimum and maximum) water depth utilization.	<p>In Normandy Reservoir, Tennessee, nests were observed at depth 10.5-12.1 ft (3.2-3.7 m) (Sammons et al. 1999).</p> <p>In Lake Perris, nest sites were observed at depths ranging from 1.6-15.1 ft (0.5-4.6 m) and averaging 8.5 ft (2.6 m) (Aasen et al. 1981).</p>	
water depth preference for spawning	Reported range of most frequently observed water depth utilization.	<p>Males construct nest at water depths averaging 8.2-9.8 ft (2.5-3m) (Moyle 2002).</p> <p>In Lake Perris, of the 88 nests observed in 1977 and 1978, 79 occurred at depth range 5 – 13 ft (1.6 – 4.0 meters) (Aasen et al. 1981).</p>	
range for spawning timing	Earliest and latest time of season or year in which spawning occurs.	<p>Spotted bass spawning takes place between late March to June. In Millerton Lake, spawning started as early as late March (Wang 1986).</p> <p>In Perris Reservoir (Riverside County), the first sign of spawning is the movement of males into shallow water in late March and early April when temperatures are 57.2°F-59°F (14°C -15°C). Spawning may continue through late May and early June, until temperatures reach 71.6°F-73.4°F (22°C - 23°C) (Aasen et al. 1981).</p> <p>In Normandy Reservoir, Tennessee, spotted bass eggs (which incubation period is 4-5 days) hatched between early April to early June (Sammons et al. 1999).</p>	
peak spawning timing	Time of year most fish start to spawn.	In Millerton Lake, spawning peaks in late-May and early-June (Wang 1986).	

Element	Element Descriptor	General	Feather River Specific
spawning frequency (iteroparous/semelparous)	Semelparous - producing all offspring at one time, such as in most salmon. Usually these fish die after reproduction. Iteroparous - producing offspring in successive, e.g., annual or seasonal batches, as is the case in most fishes.	Spotted bass are iteroparous spawners (Moyle 2002).	
Incubation/early development			
egg characteristics	Shape, size, color, in clusters or individuals, stickiness, and other physical attributes.	Eggs are spherical, demersal, and measure less than one third the diameter of smallmouth bass eggs (Wang 1986). In Lake Perris, at the time of deposition, eggs are clear. Within 2 days they turned opaque with a black spot (Aasen et al. 1981).	
water temperature tolerance for incubation	Range of water temperatures allowing survival. Indicate stressful or lethal levels.	In Normandy Reservoir, Tennessee, spotted bass eggs hatching occurred at water temperatures ranging from 61.7°F-68°F (16.5°C -20°C) (Sammons et al. 1999).	
water temperature preference for incubation	Range of suitable, preferred or reported optimal water temperatures. Indicate whether literature, observational, or experimental derivation.		
time required for incubation	Time duration from fertilization to hatching. Note: Indicate at which temperature range. Incubation time is temperature-dependent.	In Lake Perris, hatching begins on the 4 th day, and is completed by the 5 th day (Aasen et al. 1981).	
size of newly hatched larvae	Average size of newly hatched larvae.		
time newly hatched larvae remain in gravel	Time of year of hatching, and duration between hatching and emergence from gravel.	Newly hatched larvae remain in nest for 8-9 days before they disperse (Wang 1986). In Lake Perris, sac fry remained in nest 3-4 days before emergence. The yolk is absorbed within 2 days. Fry remain near the nest for 3-5 days, and then moves to shallow water at depths 1.6-4.9 ft (0.5-1.5m) (Aasen et al. 1981).	
other characteristics of larvae	Alevin -- early life history phase just after hatching (larva) when yolk-sac still present.	Fry rise off nest and form dense shoals in the vicinity, which are guarded by males until they disperse. Embryos and larvae are defended by males up to 4 weeks (Moyle 2002).	

Element	Element Descriptor	General	Feather River Specific
timing range for emergence	Time of year (earliest-latest) hatchlings (larvae and alevins) leave or emerge from the nesting/hatching (gravel) sites.	Timing range for emergence (fry leaving the nest area) is 11-17 days after nest site selection and spawning (Aasen et al. 1981).	
timing peak for emergence	Time of year most hatchlings emerge.		
size at emergence from gravel	Average size of hatchlings at time of emergence.	Fry rise off nest and form dense shoals in the vicinity at lengths up to 1.2 inches (30 mm TL) (Moyle 2002).	
Juvenile rearing			
general rearing habitat and strategies	General description of freshwater environment and rearing behavior.	Young-of-year juveniles are usually found in small shoals, while larger fish tend to be solitary (Moyle 2002).	
water temperature tolerance for juvenile rearing	Range of water temperatures allowing survival. Indicate stressful or lethal levels.		
water temperature preference for juvenile rearing	Range of suitable, preferred, or reported optimal water temperatures. Indicate whether literature, observational, or experimental derivation.		
water velocity ranges for rearing juveniles	Reported range of observed (minimum and maximum) water velocity utilization.		
water velocities preferred by rearing juveniles	Reported range of most frequently observed water velocity utilization.		
water depth range for juvenile rearing	Reported range of observed (minimum and maximum) water depth utilization.		

Element	Element Descriptor	General	Feather River Specific
water depth preference for juvenile rearing	Reported range of most frequently observed water depth utilization.		
cover preferences for rearing juveniles	Type of cover for protection from predators used by rearing juveniles (e.g. crevices, submerged aquatic vegetation, overhanging vegetation, substrate cover, undercover bank, small woody debris, large woody debris).	In reservoirs, juveniles remain near the shore in shallow water. The young of year (YOY) are usually found in small shoals (Moyle 2002).	
food base of juveniles	Indicate primary diet components. Also indicate the diet changes, if any, as growth occurs.	<p>Juveniles feed mainly on crustaceans and aquatic insects; larger juveniles also feed on small threadfin shad (Wang 1986).</p> <p>Fry feed on zooplankton or small insects in quiet waters. In streams in their native range, bass smaller than 3 inches (75 mm) TL feed mostly on aquatic insects and crustaceans. Spotted bass measuring 3-5.9 inches (75-150 mm) consume, roughly in order of importance, aquatic insects, fish, crayfish, and terrestrial insects. Crayfish and (secondarily) fish are increasingly important for larger fish (Moyle 2002).</p> <p>In reservoirs, spotted bass smaller than 1.97 inches (50 mm) TL feed mostly on zooplankton and then on terrestrial or aquatic insects; larger fish feed heavily on crayfish and fish, and to a lesser extent on aquatic insects (Moyle 2002).</p>	
feeding habits of rearing juveniles	Indicate whether plankton eater, algae eater, bottom feeder, piscivorous, active hunter, ambush predator, filter feeder. Night, day, dusk or dawn feeder. Also indicate change of feeding habits growth occurs.		
predation of juveniles	Indicate which species prey on juveniles.	Bluegill are common predators on embryos. Spotted bass also prey on their own young and the young of other bass species (Moyle 2002).	

Element	Element Descriptor	General	Feather River Specific
		In Lake Perris, green sunfish and bluegill are the major predators, the latter being the primary predators of eggs and fry. Occasionally, spotted bass will attack the nest (Aasen et al. 1981).	
timing range for juvenile rearing	Range of time of year (months) during which rearing occurs.		
timing peak for juvenile rearing	Time of year (months) during which most rearing occurs.		
Juvenile emigration			
time spent in fresh water prior to emigrating	Duration (in years and/or months) from emergence to emigration to the ocean.	N/A	
water temperature tolerances during emigration	Range of water temperatures allowing survival. Indicate stressful or lethal levels.	N/A	
water temperature preferences during emigration	Range of suitable, preferred or reported optimal water temperatures. Indicate whether literature, observational, or experimental derivation.	N/A	
emigration timing range	Time of year juveniles commence emigration and duration of emigration.	N/A	
emigration timing peak	Time of year most juveniles are emigrating.	N/A	
size range of juveniles during emigration	Minimum and maximum sizes (inches or mm) of emigrating juveniles. Indicate average size.	N/A	
factors associated with emigration	Pulse flows, water temperature changes, turbidity levels, photoperiod, etc.	N/A	
Other potential factors			
DO	Levels of dissolved oxygen in water expressed in mg/l tolerated by fish.		

Element	Element Descriptor	General	Feather River Specific
pH	Alkalinity/acidity of water (expressed in pH) that fish can tolerate.		
turbidity	Indicate turbidity or state of water (e.g., clear water or presence of siltation or organic/inorganic matter in water) that fish can tolerate.		
factors contributing to mortality	e.g. fishing/angling mortality, drastic habitat alterations, unfavorable climatic changes, etc.		

References

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